REMARKS

Claims 1-18 remain pending in this application. Claims 17 and 18 have been withdrawn from consideration as being directed towards a non-elected invention. Each of the examined claims is believed to define an invention which is novel and unobvious over the cited references. Favorable reconsideration of this case is respectfully requested.

Copies of Figures 3A and 3F and Figure 4 are submitted herewith on separate sheets with the corrections requested by the Examiner indicated in red ink. Upon the approval of the Examiner and the indication of allowable subject matter, these changes will made by a draftsman of the undersigned.

The original title of the invention has been canceled and replaced with a new title, which is clearly indicative of the invention to which the claims are directed.

The present relates to a method of etching semiconductor devices using a hydrogen peroxide-water mixture. The hydrogen peroxide-water mixture is used to etch a titanium or a titanium nitride film. Using a hydrogen peroxide-water mixture for etching titanium or titanium nitride films avoids an increase in sheet resistance and an increase in the fluctuation in the resistance of the $CoSi_2$ that is present. Please see the present specification, for example, page 5, lines 15-20, for this and other advantages of the present invention.

Claims 1, 4, 5, 8, 9, 12, 13 and 16 have been rejected under 35 U.S.C. 102(b) as being anticipated by Applicants admitted prior art Figures 3A-3F.

The admitted prior art disclosed in the present specification does not anticipate the present invention as it does not disclose, among other things, removing the titanium nitride film using a hydrogen peroxide-water mixture.

Figures 3A-3F of the present specification describe a prior art method of forming semiconductors. Various semiconductor device features are formed on the semiconductor substrate 100. A cobalt film 110 is then formed to cover a substrate 100 and the device features. A titanium nitride film 112 is formed as a cap film to cover the top of the cobalt film 110 as is shown in Figure 3B. A rapid thermal annealing is then performed. Next, as shown in Figure 3D, the titanium nitride film 112 is removed using the ammonia-hydrogen peroxide-water mixture, please see page 3, lines 17-19. Thus, it is clear that the prior art described in the specification only discloses using an ammonia-hydrogen peroxide water mixture to remove the titanium nitride film, not the use of a hydrogen peroxide-water mixture.

Each of the rejected claims recites that the titanium nitride film is removed using hydrogen peroxide-water mixture, not an ammonia-hydrogen peroxide-water mixture as is disclosed in the prior art.

Moreover, claims 4, 5, 9, 12 and 13 recite a two step etching process for the titanium film that is not disclosed in the prior art described in the specification. These claims recite removing a first portion of the titanium film by a first removal step using an ammonia-hydrogen peroxide water mixture whereby a second portion of the titanium film remains. The second portion of the titanium film is then removed by a second

removal step using a hydrogen peroxide-water mixture. There is no disclosure of this two step process in the admitted prior art or, as described above, for removing the titanium film using a hydrogen peroxide-water mixture.

Anticipation requires the disclosure, in a prior art reference, of each and every limitation as set form in the claims. Titanium Metals Corp. v. Banner, 227 USPQ 773 (Fed. Cir. 1985); Orthokinetics, Inc. v. Safety Travel Chairs, Inc. 1 USPQ2d 1081 (Fed. Cir. 1986); Akzo N.V. v. U.S. International Trade Commissioner, 1 USPQ2d 1241 (Fed Cir. 1986). There must be no difference between the claimed invention and reference disclosure for an anticipation rejection under 35 U.S.C. 102. Scripps Clinic and Research Foundation v. Genetech, Inc., 18 USPQ2d 1001 (Fed. Cir. 1991); Studiengesellschaft Kohle GmbH v. Dart Industries, 220 USPQ 841 (Fed. Cir. 1984).

In view of the above discussion, it is clear that the admitted prior art does not teach and every element recited in the rejected claims as is required by 35 U.S.C. 102. Therefore, the withdrawal of this rejection is respectfully requested.

Claims 2, 3, 6, 7, 10, 11, 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicants admitted prior art.

Each of claims 2, 3, 6, 7, 10, 11, 14 and 15 depends directly or indirectly from claims 1, 5, 9, or 13 and would be patentable over Applicants admitted prior art for at least the reasons described above regarding claims 1, 4, 5, 9 and 13. There is no teaching or suggestion in Applicants admitted prior art of using a hydrogen peroxide-water

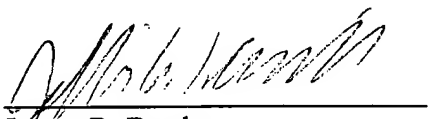
mixture to remove the titanium nitride or titanium film. Therefore, the withdrawal of this rejection is respectfully requested.

If the Examiner is of the opinion that the prosecution of this application would be advanced by a personal interview, the Examiner is invited to telephone undersigned counsel to arrange for such an interview.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "**Version with markings to show changes made.**"

The Commissioner is authorized to charge any fee necessitated by this Amendment to our Deposit Account No. 22-0261.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE TITLE:

Please delete the title of the disclosure and replace with the following:

METHOD OF ETCHING SEMICONDUCTOR DEVICES USING A HYDROGEN PEROXIDE-WATER MIXTURE

IN THE DISCLOSURE:

Page 4, please replace the third full paragraph with the following rewritten paragraph:

There are problems when the $CoSi_2$ is worn away in this manner in that $CoSi_2$ sheet resistance increases and the fluctuations in resistance become larger, etc. The reason for this is that when titanium nitride film is removed with ~~a sulfuric acid~~ an ammonia-hydrogen peroxide-water mixture, the film is etched up to the CoSi layer, which is on the bottom of the titanium nitride film, and as a result, the CoSi film becomes thinner, and the $CoSi_2$ film that is then formed by the second RTA treatment becomes even thinner.

Page 17, please replace the first full paragraph with the following rewritten paragraph:

Next, as shown in Figure 1(C), first RTA treatment is performed, at a temperature within a temperature range of 450°C to 600°C, between each of the cobalt film 20

adjoining diffusion layer 12 and diffusion layer 12 and cobalt film 20 adjoining gate electrode 18 and gate electrode 18 to form CoSi layers 24a, 24b and 26 as a result of the reaction. Part of cobalt film 20 adjoining field insulation film 14 and side walls 19 remains as unreacted cobalt film after this RTA treatment.

Page 18, please replace the second full paragraph with the following rewritten paragraph:

Consequently, it is possible to avoid a subsequent increase in sheet resistance and an increase in fluctuations in resistance of the $CoSi_2$ that ~~has~~ have been formed by the second RTA treatment.

Pages 19 and 20, please replace the fifth full paragraph which continues on page 20 with the following rewritten paragraph:

Next, as shown in Figure 2(C), first RTA treatment is performed, at a temperature within a temperature range of 450°C to 600°C, between each of cobalt film 60 adjoining diffusion layer 52 and diffusion layer 52 and cobalt layer 60 adjoining gate electrode 58 and gate electrode 58 to form CoSi layers 64a, 64b, and 66 as a result of this reaction. Part of cobalt film 60 adjoining field insulation film 54 and side walls 59 remains as unreacted cobalt film after this RTA treatment.

IN THE CLAIMS:

Please amend the claims as follows:

9. (Amended) A method of producing semiconductor devices by cobalt salicide technology with titanium nitride film as the cap film, comprising:

removing a first portion of said titanium nitride film by a first removal step using an ammonia-hydrogen peroxide-water mixture such that a second portion of said titanium nitride film remains; and

removing said second portion of said titanium nitride film by a second removal step using a hydrogen peroxide-water mixture.

12. (Amended) A method of producing semiconductor devices, comprising:

forming cobalt film on the top surface of a silicon substrate, which has a gate electrode and a diffusion film;

forming titanium nitride film as the cap film on the top surface of said cobalt film;

selectively reacting the silicon of said silicon substrate and the cobalt of said cobalt film;

removing a first portion of said titanium nitride film by a first removal step using an ammonia-hydrogen-peroxide-water mixture such that a second portion of said titanium nitride film remains; and

removing said second portion of said titanium nitride film by a second removal step using a hydrogen peroxide-water mixture.

13. (Amended) A method of producing semiconductor devices by cobalt salicide technology with titanium film as the cap film, comprising:

removing a first portion of said titanium film by a first removal step using an ammonia-hydrogen peroxide-water mixture such that a second portion of said titanium nitride film remains; and

removing said second portion of said titanium film by a second removal step using a hydrogen peroxide-water mixture.

16. (Amended) A method of producing semiconductor devices, comprising:

forming cobalt film on the top surface of a silicon substrate, which has a gate electrode and a diffusion layer;

forming titanium film as the cap film on the top surface of said cobalt film;

selectively reacting the silicon of said silicon substrate and the cobalt of said cobalt film;

removing a first portion of said titanium film by a first removal step using an ~~am~~monia-hydrogen peroxide-water-mixture such that a second portion of said titanium film remains; and

removing said second portion of said titanium film by a second removal step using a hydrogen peroxide-water mixture.